

**NERRS Science Collaborative Progress Report for the Period November 1, 2011 through February 29, 2012**

**Our Coast, Our Future: Planning for Sea Level Rise and Storm Hazards in the San Francisco Bay Area**

**Principal Investigators:** Patrick Barnard, Grant Ballard

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**Report compiled by:** Marina Psaros

**Contributing team members and their role in the project:** Patrick Barnard (applied science PI), Grant Ballard (applied science PI), Nathan Elliot (informatics engineer), Thomas Fonseca (informatics engineer), Kelley Higgason (project coordinator), Marina Psaros (collaboration lead), Sam Veloz (quantitative ecologist), Julian Wood (collaboration liaison)

**A. Progress overview: State the overall goal of your project, and briefly summarize in one or two paragraphs, what you planned to accomplish during this period and your progress on tasks for this reporting period. This overview will be made public for all reports, including confidential submissions.**

The ultimate goal of the “Our Coast, Our Future” (OCOF) project is to provide the tools and information needed for local decision-makers to develop climate change adaptation strategies, and take actions to ensure healthy, viable, and sustainable coastal ecosystems and communities. We plan to accomplish this goal by producing science-based, online decision-support tools to help local decision makers plan for and respond to sea level rise and storm hazards along the San Francisco Bay shoreline. The support tools will be built in collaboration with end users. A fine scale resolution (2 meter) Digital Elevation Model and localized extreme storm and sea level rise scenarios will be developed to underlie the tools. This project builds on a related effort already underway on the North-central California outer coast (referred to hereafter as “Outer Coast”), and the resulting tools will be available for the shoreline of the entire 9-county San Francisco Bay Area.

This is the first reporting period for the project. Since the project’s launch 3 months ago, the team has focused on various startup activities including: gathering data and information; conducting preliminary assessments; introducing the project to key stakeholder groups; interfacing with expert peers; and setting up structures to support the project in the future. Because many of the project team members were already working together on a related project on the Outer Coast, we have been able to ramp up efforts quickly and the project has already achieved significant momentum.

**B. Working with Intended Users:**

- Describe the progress on tasks related to the integration of intended users into the project for this reporting period.**

The project team has had a number of early interactions with end users that have underscored the interest in this project and its potential importance to the region. Interactions have ranged from

informal conversations with individuals at key organizations to invited presentations at meetings of the Bay Area Ecosystem Climate Change Consortium, the San Francisco Estuary Partnership, and the North Bay Watershed Association.

The Intended User that the project team has worked most closely with during this reporting period has been the San Francisco Bay Conservation and Development Commission (BCDC). Marina Psaros, Grant Ballard, and Julian Wood have been part of a workshop planning team with BCDC and NOAA's Coastal Services Center (described in greater detail in the next section). Wood and Patrick Barnard have also been engaged in the Adapting to Rising Tides (ART) project that is focused on helping East Bay communities plan for sea-level rise (<http://risingtides.csc.noaa.gov/>). The goal of Wood's interactions is to learn about BCDC's needs in helping natural resources managers and regulated organizations plan for sea level rise. Wood and Sam Veloz have met with key BCDC staff to review and help modify BCDC's Natural Areas Vulnerability Assessment matrix, and explore how BCDC's matrix and PRBO's existing San Francisco Bay Sea Level Rise Tool could be improved and serve as a starting point for OCOF products.

Psaros and Wood have each been in contact with other key organizations in Bay Area climate change adaptation work. They have both met with Bay Area Climate and Energy Resilience Advisory Group staff to better understand the environment in which local and regional Bay Area planners operate and the particular needs that this end user group has with regard to climate change adaptation planning. Psaros has had discussions with San Francisco Estuary Partnership and Bay Area water boards' staff to learn about current and near-future climate change adaptation projects, and Wood has met with Sonoma Land Trust staff to discuss how the current PRBO SLR Tool user interface and products could be improved to better meet Sonoma Land Trust's needs.

Barnard has been in contact with the CaSCADE2 project, a multi-agency project housed by the USGS Water Resources Division, which will focus on the ecological impacts of climate change in the Bay Area. His interactions with Dan Cayan, Mike Dettinger, and Noah Knowles have enabled OCOF to have future access to the many products they are developing which will directly improve our effort, including downscaled products from Global Climate Models (e.g., winds and pressure fields), and projections of Delta discharge and sediment supply to the Bay through 2100.

These initial interactions have helped the project team understand how OCOF can tie into other existing climate change initiatives. Information gathered from these interactions has also informed the development of a semi-structured interview protocol; needs assessment framework; and initial plans for the Open House kickoff event.

- **What did you learn? Have there been any unanticipated challenges or opportunities?**

We have learned that there is high interest and activity in local climate change adaptation from governmental, academic, private, and community sectors. This presents the OCOF team with both a challenge and an opportunity: how can we best collaborate with other organizations that are also developing decision-support mechanisms to ensure that our efforts are synergistic and not duplicative? One early example will illustrate how we are approaching the situation:

As we began early preparations in January for the OCOF Open House that was to serve as our kickoff event, it came to our attention that BCDC was planning to hold a climate change adaptation planning workshop with the same audience, and within a month of our original planned date. Members of the OCOF team, BCDC, and NOAA's Coastal Services Center (who will be launching their

Sea Level Rise Viewer in California later this year) then met to discuss this, and quickly came to the conclusion that we should combine our efforts into a single event. We have come to see this as an opportunity for our organizations to strengthen our own “internal” communications and cooperative work plans, as well as an opportunity for us to frame the adaptation assistance work that we are all doing in a way that is clear, concise, and understandable to the communities of resource managers, planners, regulators, and other decision-makers that our organizations serve. We are in the process of collaboratively developing an agenda that satisfies the needs of each organization, and the effort has been a good experience in creativity and cooperation.

- **Who has been involved?**

Many members of the project team have ongoing relationships with one or more individuals from our Intended User organizations, and the OCOF project has provided an opportunity to deepen and expand those relationships. Psaros, Wood, Ballard, and Veloz in particular have been actively engaging with Intended Users and partner organizations, and Project Coordinator, Kelley Higgason, will also be significantly engaged in this work as she returns from maternity leave.

- **Has interaction with intended users brought about any changes to your methods for integration of intended users, the intended users involved, or your project objectives?**

As described above, we have changed plans for our Open House event. We have also discovered two opportunities to collaborate on the development of the needs assessment so that this effort avoids duplication and serves the widest audience possible:

1. Work with the EBM Tools Network to expand and update a matrix of tools and data sources that was originally developed by the San Francisco Bay Coastal Training Program and EBM Tools Network.
2. Partner with the Bay Area Climate and Energy Resilience Advisory Group, which is developing a “Climate and Energy Resiliency Project” targeted at leaders in local governments, universities, foundations, and businesses.

- **How do you anticipate working with intended users in the next six months?**

The next six months will be a critical period for intended user involvement. During this period, we will be holding our Open House and convening the advisory committee. The Outer Coast tool will be piloted with focus groups, and we intend for the Outer Coast work to inform our work in the Bay. Team members will continue to interface with individuals from Intended User organizations, and the project team will meet in March to discuss how we can best ensure that our own communications internally and with Intended Users remains streamlined and consistent.

### **C. Progress on project objectives for this reporting period:**

- **Describe progress on tasks related to project objectives for this reporting period.**

The following tasks were scheduled to begin during this reporting period. The full timeline from which the below items are excerpted can be found in the Final Proposal:

1. Project team meetings / management: While Higgason was on maternity leave, Psaros filled

the role of project coordinator. Project team members participated in the NSC Orientation call; the team held two additional meetings to discuss both Bay and Outer Coast progress; and several informal calls and meetings have occurred between various project team members in the course of everyday work.

2. Preliminary interviews with Intended Users: As described in Section B, informal exchanges with several Intended Users have already taken place, and a draft interview protocol has been created. These semi-structured interviews will take place in late March.
3. Project Open House Meeting for SF Bay: As detailed in Section B, planning for this event is already underway, and the event is targeted to be held in late April or May 2012.
4. Needs Assessment for SF Bay: As described above, this task is underway and has created an opportunity to collaboratively develop several pieces of the document with other entities to avoid duplication of work and ensure the highest quality products. The Needs Assessment for the OCOF project is targeted to be available in summer 2012.
5. Create new Digital Elevation Model and SLR / flood scenarios: The USGS Earth Resources Observation and Science center is currently constructing the Digital Elevation Model for the Bay, due to be completed by October 2012. In Year 1, we are planning to modify the USGS subcontract so we can assess vertical land movements along the Bay Area shoreline, where rates are as high as 2 cm/year. Further details on this change are described below.

- **What data did you collect?**

For the web tool, Fonseca, Elliot, and Moody have been seeking out, collecting, and managing data for the San Francisco Bay Area. Data fall primarily into three categories: human infrastructure, jurisdictional boundaries, and natural resources. Data gathered for human infrastructure consist of layers for roads, highways, railroads, ports, airports, mass transportation, bus and other stations, water treatment plants, centers of government, police and fire stations, hospitals, schools, community centers, other public buildings, power plants, mines, and shopping centers among others. Data gathered for jurisdictional boundaries include layers for county, school district, fire district, water district, military, park service, parcel, and other boundaries. Data gathered for natural resources and conservation include layers for wetlands, streams, seal and sea lion haulouts, beaches, state parks, national parks, local parks and open spaces, private conservation holdings, and USFWS critical habitats. Data have been gathered from a multitude of sources, including CalTrans, the US Census, the National Hydrological Database, the US Fish and Wildlife Service, the National Park Service, Bay Area counties, and a number of private institutions.

A number of steps to standardize and homogenize the data have also been undertaken. Metadata availability and completeness have been assessed, data have been cropped to the study region where necessary, re-projected to standard coordinate system, and made ready for use. These layers will be used in an interactive map to show the vulnerability of such assets to a variety of climate change-related sea-level rise scenarios. To further the use of this information, we have been working on creating a series of out-of-the-box queries and reports, which could be used to assess the effects of sea-level rise in a user-selected area.

- **Has your progress in this period brought about any changes to your methods, the integration of intended users, the intended users involved or the project objectives?**

For the model, Barnard conducted an intensive investigation and consultations with other experts, which led us to determine that we had overlooked the potential impact of vertical land motion in

assessing future vulnerability of the San Francisco Bay shoreline. The largest vertical rates of change measured in the San Francisco Bay area are due to non-tectonic processes, particularly the consolidation (i.e., subsidence) of Bay mud and artificial fill that comprise a large proportion of the area's shoreline. For example, the northwestern tip of Treasure Island dropped ~2 cm/yr from 1992-2000 (Ferretti et al., 2004), and subsidence up to 1 cm/year occurs along natural, mud-dominated shoreline areas (Bürgmann et al., 2006), essentially up to an order of magnitude *higher* than global SLR. Therefore, we felt it was essential to include this movement component into our project to more accurately characterize future vulnerability. In effect, we will create a moveable DEM based on the last 20 years of vertical land motion along the Bay Area determined by 100's of IfSAR satellite passes, and prorate that movement based on the time horizon (e.g., 2050, 2100) being modeled. Including vertical land movement into the underlying scenarios will add an essential component to the scope of work to make our effort more robust and defensible both to the scientific community and to the management community. Barnard has secured additional funds to ensure that the original scope of work as well as the additional work can be completed for the OCOF project. A Project Change Request with additional details on funding sources and budget changes is being submitted to the NERRS Science Collaborative along with this progress report.

- **Have there been any unanticipated challenges, opportunities, or lessons learned?**

Psaros, the Collaboration Lead, has left her position as the Coastal Training Program Coordinator at the San Francisco Bay NERR. The project team is pleased that she will continue to fill her role on this project as a subcontractor through PRBO Conservation Science. While we anticipate a smooth transition, successful project outcomes, and the use of our tools by at least two of the SF Bay NERR signatory partners, we are interested in pursing additional activities to ensure that both the SF Bay NERR and the national NERR system receive maximum benefit from this project. Activities identified so far:

1. Throughout the life of the project, the SF Bay NERR Reserve Manager has agreed to provide feedback and input to the project team; liaise with SF Bay NERR signatory partners; and represent the project at national NERR events;
2. The advisory committee for the project team will include the Bay Conservation and Development Commission (a signatory NERR partner and the CZMA agency for the Bay) and the Solano Land Trust (the land managing organization for the China Camp component);
3. Psaros will continue to work with other CTP Coordinators to disseminate lessons learned from NERRS Science Collaborative-funded projects. Specific activities could include: presenting at gatherings such as the CTP Climate Training Workgroup calls, sector or annual NERR meetings, and professional conferences; writing manuscripts with other Science Collaborative-funded NERR staff; and communicating directly with individual Collaboration Leads.

- **What are your plans for meeting project objectives for the next six months?**

We will continue to diligently work with research partners, coastal managers, and end users to define and develop state-of-the-art tools. We will meet our project objectives through the following activities:

1. Complete logic model for collaborative process
2. Hold Open House in cooperation with BCDC and NOAA CSC

3. Conduct interviews with Intended Users
  4. Conduct Needs Assessment
  5. Convene advisory group
  6. Develop flexible framework for web-based decision support tool
  7. Continue work on DEM and SLR / flood scenarios
  8. Integrate lessons learned from Outer Coast project into Bay project
- D. Benefit to NERRS and NOAA:** List any project-related products, accomplishments, or discoveries that may be of interest to scientists or managers working on similar issues, your peers in the NERRS, or to NOAA. These may include, but are not limited to, workshops, trainings, or webinars; expert speakers; new publications; and new partnerships or key findings related to collaboration or applied science.

Several outputs and outcomes planned for this year may be of interest to NERRS and NOAA staff:

1. Veloz has been invited to present the OCOF project at the Society for Conservation Biology conference later this year. This conference often attracts NERR staff and we could make his presentation available for interested individuals.
2. The updated Data and Tools matrix can be distributed to other Coastal Training Program Coordinators for distribution at appropriate events. An earlier version of this document has already been distributed through the California CTPs.
3. Psaros and Lisa Auermueller, the Collaboration Lead and CTP Coordinator at the JC NERR, have discussed similarities between two NSC-funded projects that seek to collaboratively develop web-based climate change decision-support tools. Psaros and Auermueller see an opportunity to use these experiences as a model for NERRS to partner with NOAA's Coastal Services Center on localized SLR support tools.
4. Ballard has accepted an invitation to participate on the steering committee for the development of a technical update to the San Francisco Baylands Ecosystem Habitat Goals report. The update will focus on incorporating assessment of the predicted impacts of climate change and associated adaptation strategies. This role will provide the project the opportunity to transmit highly relevant project results directly into the guiding restoration and enhancement document for the Bay, as well as to learn from stakeholders in the Goals report update what information is most needed from our project.

**E. Describe any activities, products, accomplishments, or obstacles not addressed in other sections of this report that you feel are important for the Science Collaborative to know.**

We investigated bringing a TIDES intern to the project through San Francisco State University, the lead state partner for the San Francisco Bay NERR. Because the SF Bay NERR staffing situation has been in flux recently, we would like to put off hosting an intern until a later date. Once we are prepared to bring on an intern, we will be able to leverage the information we have already gathered regarding payment, housing, office space, scope of work, University privileges, and equipment.